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(54) SECONDARY COMBUSTION CHAMBER MOUTHPIECE FOR DIESEL ENGINE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a secondary combustion chamber mouthpiece for diesel engine, excellent in high temp. strength, thermal fatigue resistance, and high temp. deformation resistance.
SOLUTION: This mouthpiece is composed of a heat resistant stainless steel which has a composition consisting of 15-27% Cr, 1-8% Ni, 0.1-2.0% Mn, 0.1-2.0% Si, 0.3-2.5% Nb, 0.1-2.5% W, 0.002-0.1% Zr, 0.002-0.1% B, 0.06-0.2% C, 0.01-0.15% N, and the balance Fe with inevitable impurities and containing, if necessary, at least one kind among the following (a), (b), (c): (a) 0.01-2.0% of one or ≥2 elements among Ta, Ti, and V; (b) 0.01-2.0% of one or ≥2 elements among Mo, Co, and Cu; (c) either or both of 0.01-2.0% Al and 0.001-0.05% rare earth elements including Y. Further, this stainless steel has a three-phase structure consisting of, by volume, 20-80% of ferritic phase, 0.3-7% of carbonitride phase, and the balance austenitic phase.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the secondary combustion chamber cap for diesel power plants excellent in high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic.
[0002]
[Description of the Prior Art]Generally, as shown in the partial sectional view of drawing 1, the cap 1 is formed in the secondary combustion chamber of the diesel power plant, and as for this cap 1, high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic are demanded. In drawing 1, an injection nozzle and 3 show a glow plug, 4 shows a cylinder block, and 2 shows a piston 5. As a secondary combustion chamber cap of this diesel power plant, by weight %, Cr:16-20%, Mn: 0.1-2.0%, Si:0.1-2.0%, Mo : 1.1 to 2.4%, Nb: 0.3-2.1%, Ta:0.1-2.2%, Co : 0.2 to 2.5%, Contain C:0.1 to 0.2%, and N:0.05 to 0.15%, and further, If needed, nickel:0.2-2.5% and W:0.2 to 2.5% are contained, and the secondary combustion chamber cap for diesel power plants which comprised a Fe-Cr system alloy casting which has the presentation which the remainder becomes from Fe and an inevitable impurity is known (refer to JP,7-228952,A).
[0003]
[Problem(s) to be Solved by the Invention]However, the cap attached to a secondary combustion chamber with highly-efficient-izing of a diesel power plant, In the secondary combustion chamber cap for diesel power plants which much more high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic were required, and comprised a **** cage and a conventional Fe-Cr system alloy casting, this demand was not fully able to be satisfied.
[0004]
[Means for Solving the Problem]Then, this invention persons wholeheartedly as a result of research into the conventional Fe-Cr system alloy. Zr : if heat treatment of isothermal maintenance is performed [900-1050 **] after dissolving a Fe-Cr system alloy which considers it as a presentation which added 0.002 to 0.1%, and B:0.002 to 0.1%, and has the presentation further, Are volume % and Ferrite phase:20-80%, carbon nitride phase:0.3-7%, Remainder: Becoming a three-phase-circuit organization which consists of austenite phases, a secondary combustion chamber cap for diesel power plants which comprised heat resistance stainless steel which has this three-phase-circuit organization

acquired knowledge of excelling in high temperature strength, elevated-temperature oxidation resistance, and heat-resistant fatigue characteristics conventionally.
[0005]This invention is made based on this knowledge, and is weight %, Cr: 15-27%, nickel:1-8%, Mn:0.1-2.0%, Si : 0.1 to 2.0%, Nb: 0.3-2.5%, W:0.1 to 2.5%, Zr : 0.002 to 0.1%, B:0.002 to 0.1%, C:0.06 to 0.2%, and N:0.01 to 0.15% are contained, If needed One sort in (a) Ta, Ti, and V, or : [two or more sorts of] 0.01 to 2.0%, (b) One sort in Mo, Co, and Cu, or : [two or more sorts of] 0.01 to 2.0%, aluminum : (c) At least one of 0.01 to 2.0%, and R:0.001 to 0.05% of sorts. The above (a) A presentation which contains at least one sort in - (c), and the remainder becomes from Fe and an inevitable impurity, And it is volume % and has the feature ferrite phase:20-80% and carbon nitride phase:0.3-7% in a secondary combustion chamber cap for diesel power plants which consists of heat resistance stainless steel which has a three-phase-circuit organization which consists of a remainder:austenite phase.
[0006]A reason which limited alloy composition and an organization of a secondary combustion chamber cap for the product diesel power plants made from heat resistance stainless steel of this invention to below like the above is explained in full detail.
A, component composition Cr : although Cr components act to raise remarkably the elevated-temperature oxidation resistance of a secondary combustion chamber cap for diesel power plants which dissolves to an austenite phase and a ferrite phase, and consists of heat resistance stainless steel, At less than 15%, the effect has little the content, and since a sigma phase which is a harmful phase will deposit and embrittle and toughness will fall rapidly if contained on the other hand exceeding 27%, it is not desirable. Therefore, a Cr content contained in heat resistance stainless steel for producing a secondary combustion chamber cap for diesel power plants of this invention was determined as 15 to 27%. The much more desirable range of a Cr content is 16 to 21.5%.
[0007]Although there is an operation which raises elevated-temperature oxidation resistance and toughness under coexistence with Cr, as for the effect, less than 1.0% is [the content] insufficient, and if contained on the other hand exceeding 8%, since it will become difficult to secure heat-resistant fatigue characteristics, a nickel:nickel ingredient is not preferred. Therefore, a Ni content contained in heat resistance stainless steel for producing a secondary combustion chamber cap for diesel power plants of this invention was determined as 1.0 to 8%. The much more desirable range of a Ni content is 2 to 7%.
[0008]although Mn:Mn is an ingredient which has an effect in deoxidation at the time of the dissolution, an effect of a request of the content at less than 0.1% is not acquired, but if it adds too much on the other hand so much more than 2.0%, it will check oxidation resistance. Therefore, a Mn content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.1 to 2.0%. The much more desirable range of a Mn content is 0.3 to 1.5%.
[0009]Although it has the deacidification at the time of the dissolution and there is an operation which raises fluidity, less than 0.1% of Si:Si is [the content] insufficient, and if it adds too much exceeding 2.0%, on the other hand, it will check oxidation resistance by deposit of a harmful phase. Therefore, a Si content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.1 to 2.0%. The much more desirable range of a Si content is 0.3 to 1.5%.

[0010]Although Nb:Nb has the operation which mainly forms carbon nitride of M (CN) mold, dissolves on a base further, and increases high temperature strength and heat-resistant fatigue characteristics, as for the effect, less than 0.3% is [the quantity] insufficient, and quantity which, on the other hand, exceeded dissolution to carbon nitride formation and a base when it added too much so much exceeding 2.5% is not preferred in order to lead to a deposit of a harmful phase and to check toughness. Therefore, Nb content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was determined as 0.3 to 2.5%. The much more desirable range of Nb content is 1.1 to 2.0%.
[0011]W: W has the operation which controls a deposit of a sigma phase while it dissolves on a base and increases high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic, but. Since toughness and ductility will be remarkably degraded if an effect of a request of the content at less than 0.1% is not acquired but it is made to contain exceeding 2.5% on the other hand, it is not desirable. Therefore, W content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.1 to 2.5%.
[0012]Although Zr:Zr strengthens a grain boundary and it has the operation which carries out minuteness making of the carbon nitride, and raises high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic, Since a harmful phase will deposit and toughness and ductility will be remarkably degraded if an effect of a request of the content at less than 0.002% is not acquired but it is made to contain exceeding 0.1% on the other hand, it is not desirable. Therefore, Zr content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.002 to 0.1%.
[0013]B: Although B strengthens the grain boundary, and raises high temperature strength and there is an operation which carries out minuteness making of the carbide and raises toughness, Since a harmful phase will deposit and toughness and high temperature strength will fall if an effect is not acquired but the content also makes a request contain exceeding 0.1% at less than 0.002% on the other hand, it is not desirable. Therefore, B content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel engines of this invention was defined to 0.002 to 0.1%.
[0014]C: Although C has the operation which forms carbon nitride and raises high temperature strength, elevated-temperature oxidation resistance, and heat-resistant fatigue characteristics with Nb, Since a desired effect is not acquired even if the content adds less than 0.06%, but carbon nitride will become superfluous on the other hand if it adds too much exceeding 0.2% **, and toughness falls, it is not desirable. Therefore, C contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.06 to 0.2%. The much more desirable range of C content is 0.07 to 0.16%.
[0015]NN has the operation which dissolves on a base (mainly austenite phase) and raises high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic while mainly forming Nb and carbon nitride under C coexistence, but. If an effect of a request of the content at less than 0.01%

is not acquired but it adds too much on the other hand so much more than 0.15%, a carbon nitride deposit will become superfluous and will check toughness. Therefore, N content contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention was defined to 0.01 to 0.15%.

[0016]Ta, Ti, V : since these ingredients have the operation which dissolves on a base and raises high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic while forming carbon nitride, are added if needed, but. If an effect of a request of the content at less than 0.01% is not acquired but it adds too much on the other hand so much more than 2.0%, quantity beyond dissolution to carbon nitride formation and a base is not preferred in order to lead to a deposit of a harmful phase and to check toughness. Therefore, one sort or two sorts or more of content of Ta, Ti, and V which are contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention were defined to 0.01 to 2.0%. The much more desirable range of one sort or two sorts or more of content of Ta, Ti, and the V is 0.04 to 1.5%.

[0017]it being added if needed, since there is an operation which resembles an austenite phase and a ferrite phase, dissolves, and raises high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic, but Mo, Co, and Cu:these ingredients. Since toughness will be checked by the deposit of a harmful phase if an effect of a request of the content at less than 0.01% is not acquired but it adds too much on the other hand so much more than 2.0%, it is not desirable. Therefore, one sort or two sorts or more of content of Mo, Co(es), and Cu(s) which are contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention were defined to 0.01 to 2.0%. The much more desirable range of one sort or two sorts or more of content of Mo, Co, and the Cu(s) is 0.04 to 1.5%.

[0018]aluminum, R : since there is an operation where these ingredients raise the adhesion of an oxide film and which raises elevated-temperature oxidation resistance, are added if needed, but. Since toughness and ductility will be checked if an effect of a request of the content at less than [aluminum:0.01%] and less than R:0.001% is not acquired, but aluminum:2.0% is exceeded on the other hand and it adds exceeding R:0.05%, it is not desirable. Therefore, at least one sort in aluminum and R which are contained in heat resistance stainless steel which constitutes a secondary combustion chamber cap for diesel power plants of this invention, It set to aluminum:0.01-2.0% (much more preferably 0.04 to 1.5%), and R:0.001 to 0.05% (much more preferably 0.004 to 0.03%), respectively.

[0019]B, an organization ferrite phase : although a coefficient of thermal expansion is a phase which is small excellent in heat-resistant fatigue characteristics, a ferrite phase, since high temperature strength will fall if a ferrite phase exists on the other hand undesirably exceeding 80% in a base, since an austenite phase increases, a coefficient of thermal expansion becomes large and heat-resistant fatigue characteristics become low too much, if it seems that less than 20% of a ferrite phase exists by volume %, it is not desirable. Therefore, a ferrite phase which exists in a base was defined to 20 to 80% by volume %.

[0020]carbon nitride phase: -- since ductility and toughness will fall if it exists on the

other hand undesirably exceeding 7%, since high temperature strength and heat-resistant fatigue characteristics become low if it seems that less than 0.3% of a carbon nitride phase exists by volume %, it is not desirable. Therefore, a carbon nitride phase which carries out uniform dispersion and exists in an austenite phase base and a ferrite phase was defined to 0.3 to 7% by volume %.

[0021]

[Embodiment of the Invention]The air dissolution of the heat resistance stainless steel which has the component composition shown in Table 1 - 5 is carried out, Cast the obtained molten metal to a mold in ROSUTO wax precision casting, and Diameter:of upper bed outside35mm, diameter of upper bed circles: -- the secondary combustion chamber cap for diesel power plants of the shape shown by 1 of drawing 1 which has a size (30 mm and height:25mm), and parallel part diameter: -- 6 mm, Parallel part length : Produce the specimen which has a size of 30 mm and these caps and the piece of a tensile test are heat-treated on the conditions shown in Table 6 - 10, The secondary combustion chamber cap for this invention diesel power plants which has an organization by which it is shown in the component composition and Table 6 - 10 which are shown in Table 1 - 5. (It is hereafter called this invention cap) 1-42, the secondary combustion chamber cap for comparison diesel power plants. (It is hereafter called a comparison cap) The specimen which has conventionally same the secondary combustion chamber caps 1-2 for diesel power plants (conventionally henceforth a cap) and said this invention caps 1-42, the comparison caps 1-8, the component composition, and the organization as the caps 1-2 1-8, and conventionally was produced.

[0022]

[Table 1]

種別		成分組成 (重量%) (残部：Feおよび不可避不純物)										
		Cr	Ni	Mn	Si	Nb	W	Zr	B	C	N	その他
本発明合金	1	19.1	3.53	0.46	0.41	1.13	0.43	0.023	0.021	0.09	0.022	-
	2	15.3	1.52	0.48	0.45	1.21	0.38	0.019	0.024	0.11	0.031	-
	3	26.8	4.04	0.42	0.43	1.11	0.22	0.024	0.022	0.10	0.043	-
	4	15.2	1.22	0.41	0.46	1.12	0.33	0.013	0.028	0.08	0.050	-
	5	20.9	7.75	0.46	0.49	1.16	0.36	0.018	0.015	0.10	0.036	-
	6	21.2	5.36	0.23	0.44	1.13	0.35	0.023	0.019	0.11	0.035	-
	7	20.3	8.70	1.90	0.45	1.11	0.34	0.026	0.020	0.09	0.052	-
	8	21.0	4.83	0.46	0.32	1.14	0.37	0.029	0.018	0.10	0.021	-
	9	20.5	6.29	0.39	1.81	1.13	0.42	0.020	0.017	0.09	0.062	-
	10	21.5	4.48	0.48	0.47	0.32	1.40	0.024	0.023	0.07	0.013	-
	11	20.9	3.02	0.52	0.50	2.41	0.16	0.018	0.025	0.15	0.121	-

[0023]

[Table 2]

種別		成分組成 (重量%) (残部：Feおよび不可避不純物)										
		Cr	Ni	Mn	Si	Nb	W	Zr	B	C	N	その他
本発明合金	12	20.8	3.77	0.47	0.48	1.23	0.18	0.012	0.029	0.08	0.040	-
	13	21.5	5.18	0.43	0.54	1.12	2.41	0.017	0.032	0.07	0.021	-
	14	20.3	4.61	0.49	0.51	1.17	0.34	0.003	0.025	0.09	0.035	-
	15	20.4	4.01	0.54	0.50	1.20	0.31	0.097	0.020	0.11	0.028	-
	16	19.5	4.23	0.52	0.52	1.13	0.33	0.022	0.002	0.10	0.031	-
	17	20.6	5.42	0.41	0.56	1.15	0.36	0.014	0.091	0.08	0.025	-
	18	20.9	5.71	0.46	0.59	1.11	0.30	0.019	0.025	0.07	0.051	-
	19	21.2	3.03	0.48	0.55	1.19	0.35	0.024	0.024	0.18	0.027	-
	20	21.0	5.27	0.51	0.50	1.17	0.40	0.022	0.030	0.10	0.015	-
	21	19.0	3.98	0.53	0.58	1.12	0.29	0.020	0.021	0.08	0.140	-
	22	16.3	2.43	0.47	0.53	1.10	0.35	0.025	0.027	0.09	0.042	-

[0024]

[Table 3]

種別		成分組成 (重量%) (残部：Feおよび不可避不純物)										
		Cr	Ni	Mn	Si	Nb	W	Zr	B	C	N	その他
本発明合金	23	21.2	6.42	0.55	0.49	1.16	0.43	0.029	0.023	0.11	0.022	-
	24	20.4	2.33	0.49	0.53	1.13	0.45	0.027	0.019	0.12	0.031	-
	25	21.0	6.85	0.45	0.57	1.20	0.39	0.033	0.025	0.10	0.044	-
	26	21.0	4.51	0.41	0.54	1.12	0.44	0.024	0.031	0.07	0.032	-
	27	20.4	4.99	0.46	0.44	1.91	0.38	0.026	0.020	0.08	0.018	-
	28	20.7	4.05	0.52	0.50	1.11	0.25	0.023	0.017	0.09	0.045	Ta:0.46
	29	21.1	3.70	0.50	0.48	1.17	0.22	0.021	0.021	0.11	0.034	Ti:0.48
	30	19.9	5.92	0.47	0.52	1.14	0.19	0.028	0.024	0.10	0.023	V:0.50
	31	20.2	5.51	0.52	0.56	1.12	0.24	0.018	0.022	0.08	0.053	Ta:0.08, Ti:0.22
	32	20.0	4.11	0.46	0.54	1.16	0.26	0.020	0.027	0.11	0.035	Ta:0.03, Ti:0.10, V:0.15

[0025]

[Table 4]

種別		成分組成（重量%）（残部：Feおよび不可避不純物）										
		Cr	Ni	Mn	Si	Nb	W	Zr	B	C	N	その他
本発明合金	33	19.8	5.29	0.40	0.51	1.13	0.21	0.014	0.030	0.10	0.020	Mo:0.32
	34	20.3	3.10	0.42	0.46	1.18	0.23	0.022	0.027	0.12	0.018	Co:0.20
	35	20.6	3.01	0.45	0.49	1.14	0.17	0.019	0.022	0.09	0.051	Cu:0.28
	36	20.9	6.03	0.52	0.53	1.12	0.19	0.018	0.020	0.11	0.042	Mo:0.11, Cu:0.18
	37	20.7	5.88	0.51	0.55	1.14	0.16	0.028	0.026	0.10	0.024	Mo:0.04, Co:0.30, Cu:0.08
	38	21.5	3.94	0.47	0.47	1.20	0.24	0.022	0.021	0.08	0.031	Al:0.21
	39	21.0	4.13	0.42	0.48	1.17	0.22	0.018	0.025	0.09	0.037	La:0.013
	40	21.4	4.25	0.44	0.53	1.19	0.21	0.026	0.029	0.11	0.040	Ta:0.12, Mo:0.13, Al:0.06
	41	20.8	6.39	0.50	0.54	1.13	0.16	0.023	0.019	0.10	0.025	Co:0.22, Ti:0.07, Ce:0.009

[0026]

[Table 5]

種別		成分組成（重量%）（残部：Feおよび不可避不純物）										
		Cr	Ni	Mn	Si	Nb	W	Zr	B	C	N	その他
本発明合金	42	20.9	3.82	0.55	0.48	1.18	0.18	0.029	0.024	0.08	0.021	V:0.05, Ti:0.08, Cu:0.04, Co:0.11, Al:0.05, Y:0.012
比較合金	1	21.2	5.69	0.52	0.44	0.71	0.23	－*	0.018	0.07	0.014	－
	2	22.2	6.02	0.48	0.51	1.21	0.45	0.15*	0.039	0.16	0.062	－
	3	20.8	7.17	0.51	0.48	0.68	0.13	0.017	－*	0.06	0.018	－
	4	22.0	5.31	0.46	0.84	1.18	1.23	0.040	0.15*	0.13	0.090	－
	5	20.5	7.97	0.52	0.46	0.18*	0.35	0.021	0.024	0.08	0.026	－
	6	21.4	2.40	0.56	0.52	3.08*	0.61	0.023	0.019	0.12	0.111	－
	7	18.8	3.78	0.49	0.55	0.62	0.23	0.018	0.027	0.02*	0.012	－
	8	20.3	3.59	0.54	0.56	2.29	0.63	0.043	0.030	0.34*	0.130	－
従来合金	1	18.5	－	0.48	0.71	1.30	－	－	－	0.16	0.079	Ta:0.12, Co:1.52
	2	18.3	0.64	0.50	0.70	1.26	0.51	－	－	0.15	0.081	Ta:1.19, Co:1.53

（＊印は、この発明の範囲から外れた値を示す）

[0027]

[Table 6]

種別		熱処理条件		組織（体積%）		
		等温保持温度（℃）	等温保持時間（hr）	フェライト相	炭窒化物相	オーステナイト相
本発明合金	1	950	24	48	1.8	残
	2	950	24	40	2.3	残
	3	950	24	78	2.4	残
	4	950	24	43	2.1	残
	5	950	24	22	2.2	残
	6	950	24	41	2.3	残
	7	950	24	57	2.5	残
	8	950	24	46	2.0	残
	9	950	24	28	2.6	残
	10	950	24	52	0.5	残
	11	950	24	70	6.8	残

[0028]
[Table 7]

種別		熱処理条件		組織（体積%）		
		等温保持温度（℃）	等温保持時間（hr）	フェライト相	炭窒化物相	オーステナイト相
本発明鋼	12	950	24	62	1.7	残
	13	950	24	53	1.4	残
	14	1000	18	41	1.8	残
	15	1050	12	68	2.0	残
	16	900	40	40	2.3	残
	17	950	24	36	1.6	残
	18	950	24	45	1.9	残
	19	950	24	76	3.4	残
	20	950	24	42	1.8	残
	21	950	24	39	3.5	残
	22	950	24	23	2.2	残

[0029]
[Table 8]

種別		熱処理条件		組織（体積%）		
		等温保持温度（℃）	等温保持時間（hr）	フェライト相	炭窒化物相	オーステナイト相
本発明合金	23	950	24	63	2.1	残
	24	950	24	76	2.5	残
	25	950	24	31	2.3	残
	26	950	24	52	1.6	残
	27	950	24	40	1.5	残
	28	1000	18	47	2.2	残
	29	1000	18	60	2.4	残
	30	1000	18	38	2.0	残
	31	1000	18	36	2.1	残
	32	1000	18	45	2.3	残
	33	1000	18	32	2.0	残

[0030]
[Table 9]

種別		熱処理条件		組織（体積%）		
		等温保持温度（℃）	等温保持時間（hr）	フェライト相	炭窒化物相	オーステナイト相
本発明合金	34	1000	18	63	2.1	残
	35	1000	18	75	2.3	残
	36	1000	18	34	2.6	残
	37	1000	18	35	2.0	残
	38	1000	18	61	1.8	残
	39	1000	18	52	1.9	残
	40	1000	18	42	2.5	残
	41	1000	18	30	2.0	残
	42	1000	18	57	1.5	残
比較合金	1	950	24	38	1.4	残
	2	950	24	42	3.8	残

[0031]
[Table 10]

種別		熱処理条件		組織（体積%）		
		等温保持温度（℃）	等温保持時間（hr）	フェライト相	炭窒化物相	オーステナイト相
比較口金	3	950	24	42	2.0	残
	4	950	24	46	3.6	残
	5	950	24	18*	2.1	残
	6	950	24	82*	3.9	残
	7	950	24	40	0.2*	残
	8	950	24	73	8*	残
従来口金	1	-	-	残	3.8	-
	2	-	-	残	3.6	-

（*印は、この発明の範囲から外れた値を示す）

[0032]These this invention caps 1-42, the comparison caps 1-8, and conventionally, using the caps 1-2 and a specimen, the following engine test was done, heat-resistant fatigue characteristics and the high-temperature-deformation-proof characteristic were evaluated, the elevated-temperature tensile test was done at 900 more **, high temperature strength was measured, and those test results were shown in Table 11 - 15.

[0033]The caps 1-2 are included in a displacement:2500cc diesel power plant, respectively the engine test this invention caps 1-42, the comparison caps 1-8, and conventionally, an engine -- number-of-rotations: -- after operating for 3 minutes at 4000 rpm, the stop was made into one cycle for 4 minutes, the 5000 cycle **** system examination was done for this, the cap was taken out after the examination, the maximum crack length and the amount of maximum deformation in a bottom nozzle-hole part of the cap were measured, and heat-resistant fatigue characteristics were evaluated for heat-resistant fatigue characteristics.

[0034]

[Table 11]

種別		エンジンテスト		引張試験
		最大変形量（mm）	最大割れ長さ（mm）	９００℃での引張り強さ（kg/mm^2）
本発明合金	1	0．02	0．3	19．1
	2	0．03	0．2	18．9
	3	0．02	0．3	19．6
	4	0．03	0．2	18．7
	5	0．02	0．5	20．0
	6	0．02	0．3	19．3
	7	0．02	0．3	19．4
	8	0．02	0．2	19．2
	9	0．01	0．4	19．9
	10	0．02	0．3	19．3
	11	0．01	0．5	21．0

[0035]
[Table 12]

種別		エンジンテスト		引張試験
		最大変形量 (mm)	最大割れ長さ (mm)	900℃での引張り強さ (kg/mm^2)
本発明合金	12	0.03	0.2	19.0
	13	0.01	0.5	21.7
	14	0.02	0.3	19.2
	15	0.02	0.2	19.3
	16	0.02	0.1	19.1
	17	0.02	0.2	19.2
	18	0.02	0.2	19.1
	19	0.02	0.3	19.4
	20	0.02	0.2	19.3
	21	0.02	0.3	19.4
	22	0.02	0.3	19.5

[0036]
[Table 13]

種別		エンジンテスト		引張試験
		最大変形量 (mm)	最大割れ長さ (mm)	900℃での引張り強さ (kg/mm^2)
本発明合金	23	0.01	0.3	19.5
	24	0.02	0.2	19.3
	25	0.02	0.4	19.5
	26	0.02	0.2	19.2
	27	0.01	0.5	20.1
	28	0.02	0.3	19.4
	29	0.01	0.4	19.8
	30	0.01	0.3	19.6
	31	0.02	0.3	19.4
	32	0.01	0.3	19.5
	33	0.02	0.2	19.4

[0037]
[Table 14]

種別		エンジンテスト		引張試験
		最大変形量（mm）	最大割れ長さ（mm）	９００℃での引張り強さ（kg/mm^2）
本発明口金	３４	０．０２	０．３	１９．２
	３５	０．０２	０．２	１９．２
	３６	０．０２	０．４	１９．４
	３７	０．０２	０．３	１９．３
	３８	０．０２	０．３	１９．２
	３９	０．０３	０．２	１９．１
	４０	０．０１	０．３	１９．５
	４１	０．０２	０．４	１９．３
	４２	０．０１	０．３	１９．２
比較口金	１	０．２２	１．５	１４．２
	２	０．０１	２．３	２０．０

[0038]
[Table 15]

種別		エンジンテスト		引張試験
		最大変形量 (mm)	最大割れ長さ (mm)	900℃での引張り強さ (kg/mm^2)
比較口金	3	0.21	1.2	13.9
	4	0.02	2.7	21.0
	5	0.18	1.6	13.2
	6	0.04	2.2	18.5
	7	0.25	1.1	13.3
	8	0.01	2.9	22.8
従来口金	1	0.07	1.3	6.0
	2	0.09	1.2	6.1

[0039]
[Effect of the Invention]The result shown in Table 1 - 15 shows that this invention caps 1-42 are [conventionally / the caps 1-2] excellent in high temperature strength, heat-resistant fatigue characteristics, and the high-temperature-deformation-proof characteristic. However, as for the comparison caps (* seal is attached and shown in the component composition from which it has separated from the conditions of this invention) 1-8 which have the component composition from which it has separated from the conditions of this invention, it turns out that the characteristic of high temperature strength, heat-resistant fatigue characteristics, or the high-temperature-deformation-proof characteristics falls.
[0040]As mentioned above, both the secondary combustion chamber caps for the product diesel power plants made from heat resistance stainless steel of this invention are excellent not only in high temperature strength but heat-resistant fatigue characteristics and the high-temperature-deformation-proof characteristic, and can contribute to the improved efficiency of a diesel power plant dramatically.

[Translation done.]